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Application of Aragonite Shells for the Removal of aqueous Metals from polluted Soils and Waste Waters

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Abstract:

The effect of the presence of the divalent metal (Me) ions Zn, Co, Pb, Mg and Ca on the Cd uptake capacity and rate of biogenic aragonite (shells) from aqueous solutions was investigated. Experiments were performed in batch-reactors using mixtures of Me-Cd bearing solutions at a fixed solid/liquid ratio of 8 grams per liter and size fraction of 1-1.5mm. Cadmium concentrations were usually fixed at 0.45 mM whereas the Me concentrations varied (1 - 0.005 mM). The uptake process took place via 3-D nucleation of Me-bearing phases onto the shell surface and microcrystalline otavite precipitation accounted on average for 70% Cd removal after 4 hours. Under the conditions used here, Zn, Co, Mg and Ca and Pb $\leq$ 0.3 mM do not have a significant effect. At higher concentrations, Pb out competed Cd for the concurrently dissolving carbonate ion and thus slowed Cd removal rates significantly. Pb and Zn were removed faster than Cd, precipitating as $PbCO_3$, $Pb_3(CO_3)_2(OH)_2$ and $Zn_5(CO_3)_2(OH)_6$ phases. For Mg a slight enhancing effect could be observed while Co was removed much slower. For low Cd concentrations, removal was below 45 % after 4 hours, when decreasing the size fraction to 0.25-0.105 mm it improved to 90 %.